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IN THE UNITED STATES INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY (IPEA/US)

International Application Number	International Filing Date	International Priority Date
PCT/US04/01798	**21 January 2004**	**22 January 2003**

Title of Invention: **APPARATUS AND METHODS FOR IONIZED DEPOSITION OF A FILM OR THIN LAYER**

Applicant: **HONEYWELL INTERNATIONAL INC.**

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RESPONSE TO THE NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

1. Applicant herewith submits replacement sheets number **16-18** to replace sheets numbered **16-18** originally filed for this application.

2. In respect of each claim appearing in the international application based on the replacement sheets submitted herewith, and in accordance with PCT Section 205, the following claim(s) is/are:

   (i) unchanged: claim(s) **2-19 and 21-38**
   (ii) cancelled: claim(s) **0**
   (iii) new: claim(s) **0**
   (iv) replacement of one or more claims as filed, as follows: **1 and 20**
   (v) the result of the division of one or more claims as filed, as follows: **0**

CERTIFICATION UNDER 37 C.F.R. 1.10*
*(Express Mail label number is **mandatory**.)*
(Express Mail Certification is optional.)

I hereby certify that this paper and the documents referred to as being transmitted therewith are being deposited with the United States Postal Service on this date **27 December 2004** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number **EV450344985US** addressed to the: Mail Stop PCT Attn: IPEA/US; Commissioner for Patents; P.O. Box 1450; Alexandria, VA 22313-1450.

EV450344985US

Kristin J. Azcona

Dear Sir:

In response to the Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, please replace original pages **16-18** with substitute pages **16-18**. There is no new matter added in this section by virtue of the amendments.

CURRENT AND REVISED CLAIMS

1. (Currently Amended) A coil assembly, comprising:

   at least one coil having a thickness;

   at least one boss coupled to the at least one coil, wherein the at least one boss comprises at least two support sections, has a diameter and wherein the diameter of the at least one boss is greater than the thickness of the at least one coil.

2. (Original) The coil assembly of claim 1, wherein the coil comprises a metal or a metal alloy.

3. (Original) The coil assembly of claim 2, wherein the metal or metal alloy comprises a transition metal.

4. (Original) The coil assembly of claim 3, wherein the transition metal comprises tantalum or titanium.

5. (Original) The coil assembly of claim 1, wherein the at least one boss comprises more than 3 bosses.

6. (Original) The coil assembly of claim 5, wherein the at least one boss comprises more than 5 bosses.

7. (Original) The coil assembly of claim 1, wherein the at least one boss comprises the same material as the coil.

8. (Original) The coil assembly of claim 1, wherein the at least one boss is coupled to the coil through a welded joint.

9. (Original) The coil assembly of claim 8, wherein the welded joint is formed by laser welding or e-beam welding.

10. (Original) The coil assembly of claim 1, wherein the at least one boss is molded to the coil as one continuous piece of material.

11. (Original) The coil assembly of claim 1, wherein the at least one boss comprises a first support section and a second support section and wherein the diameter of the first support section is different from the diameter of the second support section.

12. (Original) An ion depositing apparatus comprising the coil assembly of claim 1.

13. (Original) A sputtering chamber assembly comprising the ion depositing apparatus of claim 12.

14. (Original) A sputtering chamber assembly comprising the coil assembly of claim 1.

15. (Original) The coil assembly of claim 1, wherein the assembly comprises a heat transfer device.

16. (Original) The coil assembly of claim 15, wherein the heat transfer device comprises the at least one boss.

17. (Original) The coil assembly of claim 15, wherein the heat transfer device comprises the at least one boss and the coil.

18. (Original) The coil assembly of claim 1, wherein the coil comprises a thickness of less than about 0.2 inches.

19. (Original) The coil assembly of claim 18, wherein the coil comprises a thickness of less than about 0.13 inches.

20. (Currently Amended) A method of producing a coil assembly, comprises:

providing a coil <u>having a thickness;</u>

providing at least one boss having at least two support sections <u>and a diameter</u>; and

coupling the at least one boss to the coil, <u>wherein the diameter of the at least one boss is greater than the thickness of the at least one coil</u>.

21. (Original) The method of claim 20, wherein the coil comprises a metal or a metal alloy.

22. (Original) The method of claim 21, wherein the metal or metal alloy comprises a transition metal.

23. (Original) The method of claim 22, wherein the transition metal comprises tantalum or titanium.

24. (Original) The method of claim 20, wherein the at least one boss comprises more than 3 bosses.

25. (Original) The method of claim 24, wherein the at least one boss comprises more than 5 bosses.

26. (Original) The method of claim 20, wherein the at least one boss comprises the same material as the coil.

27. (Original) The method of claim 20, wherein the at least one boss is coupled to the coil through a welded joint.

28. (Original) The method of claim 27, wherein the welded joint is formed by laser welding or e-beam welding.

29. (Original) The method of claim 20, wherein the at least one boss is molded to the coil as one continuous piece of material.

30. (Original) The method of claim 20, wherein the at least one boss comprises a first support section and a second support section and wherein the diameter of the first support section is different from the diameter of the second support section.

31. (Original) An ion depositing apparatus comprising the coil assembly produced by the method of claim 20.

32. (Original) A sputtering chamber assembly comprising the ion depositing apparatus of claim 31.

33. (Original) A sputtering chamber assembly comprising the coil assembly produced by the method of claim 20.

34. (Original) The method of claim 20, wherein the assembly comprises a heat transfer device.

35. (Original) The method of claim 34, wherein the heat transfer device comprises the at least one boss.

36. (Original) The method of claim 34, wherein the heat transfer device comprises the at least one boss and the coil.

37. (Original) The method of claim 20, wherein the coil comprises a thickness of less than about 0.2 inches.

38. (Original) The method of claim 37, wherein the coil comprises a thickness of less than about 0.13 inches.

PAVATE ET AL. (US 2002/0047116)

The Office considers claims 1-3, 5-7, 10-17, 20-22, 24-26 and 29-36 be anticipated by Pavate et al. (Pavate). The Office also considers claims 4 and 23 to lack inventive step as being obvious in view of Pavate. The applicant disagrees, especially in view of the amendments herein. Pavate fails to teach, suggest or disclose to one of ordinary skill in the field the claimed subject matter.

Claim 1, as amended, recites:

"A coil assembly, comprising:

at least one coil having a thickness;

at least one boss coupled to the at least one coil, wherein the at least one boss comprises at least two support sections, has a diameter and wherein the diameter of the at least one boss is greater than the thickness of the at least one coil." **(emphasis added)**

Claim 20, as amended, recites:

"A method of producing a coil assembly, comprises:

providing a coil having a thickness;

providing at least one boss having at least two support sections and a diameter; and

coupling the at least one boss to the coil, wherein the diameter of the at least one boss is greater than the thickness of the at least one coil." **(emphasis added)**

The common denominator for the independent claims shown above is that they all include the recitation that the diameter of the at least one boss is greater than the thickness of the at least one coil. The present specification goes into detail as to why the new boss design enables the coil thickness to be greatly reduced. Pages 5 and 6 state:

> "Thinner, smaller and ultimately more cost efficient coils and coil sets for utilization with a deposition apparatus, a sputtering chamber system and/or ionized plasma deposition system have surprisingly been developed and will be disclosed herein. These new coils and coil sets have a similar lifetime relative to the target being used, because as stated earlier,

decreasing the difference in lifetime between the coils, coil sets and targets would, at the very least, decrease the number of times the apparatus or systems have to be shut down to replace coils before replacing both the coil and target.

In order to accomplish the goals of increasing the cost efficiency of the coils and coil sets while decreasing the amount of material used, minimizing the difference in lifetime between the coil and/or coil set and the target, and maximizing the uniformity of the film, coating and/or layer deposited on the substrate, a coil set has been developed that utilizes smaller diameter bosses and in some embodiments utilizes smaller, thinner coils.

Specifically, a coil assembly is described herein that comprises a) at least one coil; and b) at least one boss coupled to the at least one coil, wherein the at least one boss comprises at least two support sections. Methods of forming and/or producing coil assemblies are described herein and comprise a) providing a coil; b) providing at least one boss having at least two support sections; and c) coupling the at least one boss to the coil.

A contemplated coil assembly comprises at least one coil and in some contemplated embodiments, a coil assembly comprises at least two coils. As described below, contemplated coils may comprise any suitable material including metals or metal alloys. Contemplated coils may have any suitable thickness, depending on the needs of the application. It should be understood; however, that the bosses described herein allow for coil thicknesses that are significantly less than conventional coil thicknesses. In some embodiments, contemplated coils are those coils that are considered "thin". As used herein, the phrase "thin coils" means coils that comprise a thickness of less than about 0.2 inches. In other contemplated embodiments, coils comprise a thickness of less than about 0.13 inches. In yet other embodiments, coils comprise a thickness of less than about 0.1 inches to about 0.010 inches. The coil may also have a height and/or a diameter. In some embodiments, the height of the coil is less than about 3 inches. In other embodiments, the height of the coil is less than about 2.5 inches. In yet other embodiments, the height of the coil is less than about 2 inches. And in other embodiments, the height of the coil is less than about 1.5 inches."

The Pavate reference shows that the boss diameters are the same or substantially the same as the thickness of the coil. In addition, there's no teaching or suggestion in Pavate as to the diameter of the boss and how they enable a thinner coil to be utilized, as with the present application. The present application teaches how the boss design, diameter and placement on the coil allows for the coil to be surprisingly thinner and for the coil to last longer (as related

to the target being used) and need less maintenance. In addition, thin films produced in sputtering chambers utilizing these new coil and boss designs are more uniform because the boss and/or bosses act as heat transfer devices to transfer heat from the coil and/or the deposition chamber/apparatus to the outer part of the apparatus. In some embodiments, the heat transfer device is and/or acts like a heat pipe to channel heat out of the chamber or sputtering area. The transfer of heat from the coil and/or the chamber leads to a more stable secondary plasma without significant convection.

The additional cited references, including Nulman, Hong and Subramani do not correct the deficiencies of the Pavate reference with respect to claims 1 and 20. Subramani, despite discussing coil thickness, cannot be combined with Pavate to show how the boss diameter is greater than the thickness of the coil for specific reasons, such as extending coil lifetime to match that of the sputtering target, allowing for a thinner coil, secondary plasma without convection and uniform sputtered films.

Respectfully submitted,
Bingham McCutchen, LLP

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